UC San Diego

JACOBS SCHOOL OF ENGINEERING

MAE Student Handbook

2025-2026

MECHANICAL ENGINEERING
AEROSPACE ENGINEERING

mae.ucsd.edu

Welcome to the Department of Mechanical and Aerospace Engineering

Congratulations on being admitted to the Department of Mechanical and Aerospace Engineering (MAE) in the Jacobs School of Engineering. We are sure you have questions about what to do next. We hope that this handbook will help you get familiar with our department's policies and expectations. If there are questions or concerns that are not answered, please feel free to contact us.

MAE Undergraduate Academic Advising

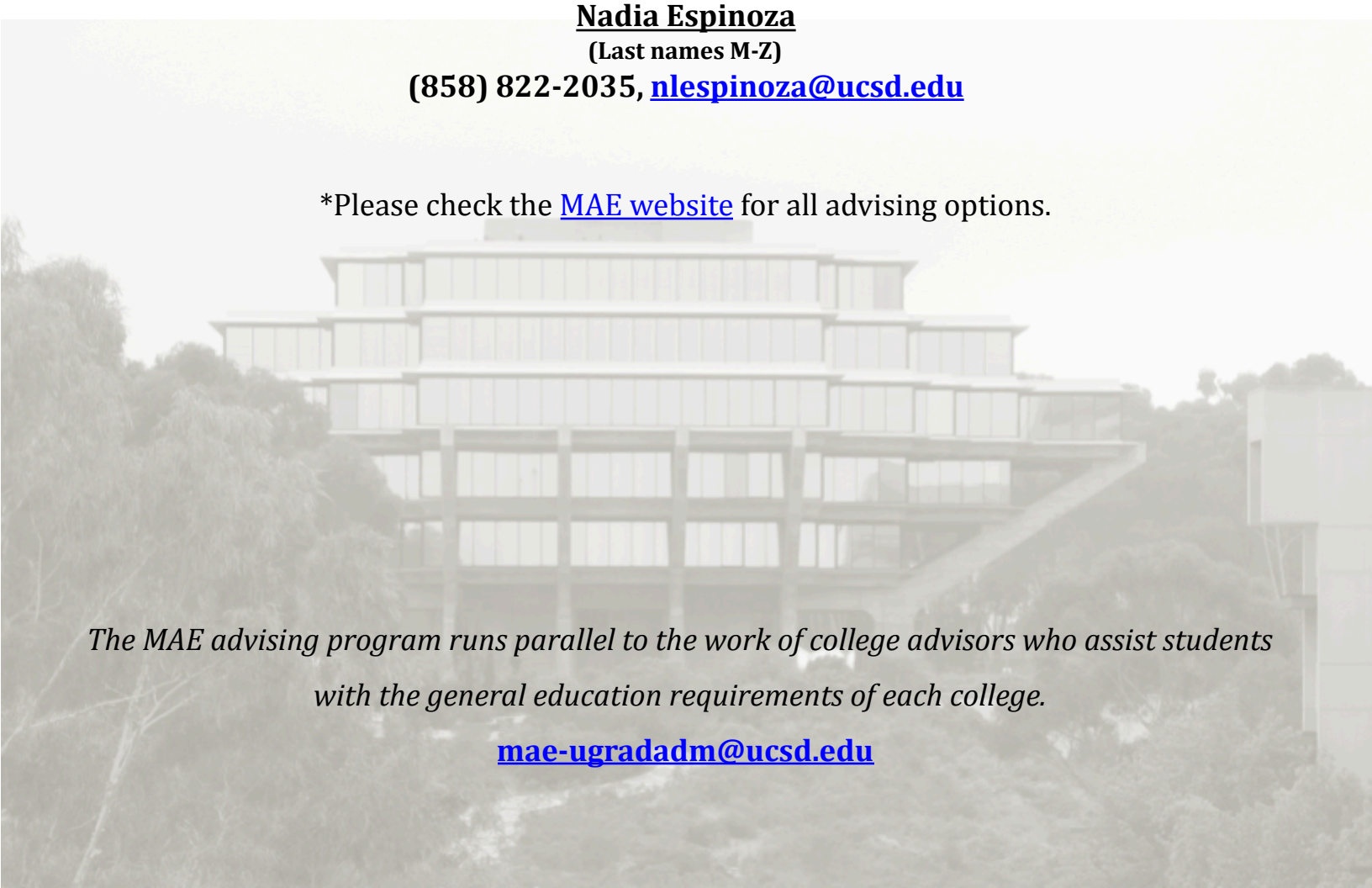
The MAE advising staff assists students with their programs of study.

The advising staff is available in EBU II, first floor for advising.

Chad Baldwin
(Last names A-L)
(858) 534-0114, chbaldwin@ucsd.edu

Nadia Espinoza
(Last names M-Z)
(858) 822-2035, nlespinoza@ucsd.edu

*Please check the MAE website for all advising options.



The MAE advising program runs parallel to the work of college advisors who assist students with the general education requirements of each college.

mae-ugradadm@ucsd.edu

MAE PROGRAM EDUCATIONAL OBJECTIVES

Five to ten years after completing our program, our alumni are expected to:

1. Enjoy successful careers where they utilize a strong technical foundation to excel as engineers, technology leaders, innovators, or other contributors to society.
2. Keep pace with rapid technological change and further develop their knowledge and skills across a range of disciplines throughout their professional careers or in pursuit of advanced education.
3. Lead local or global teams, where they will communicate effectively, interact ethically and knowledgeably, and take into account societal issues to provide a positive impact on society.

MISSION STATEMENT

"Educate Tomorrow's Technology Leaders.
Conduct Leading Edge Research and Drive Innovation.
Transfer Discoveries for the Benefit of Society."

"To foster the best possible working and learning environment, our university strives to maintain a climate of fairness, cooperation, and professionalism, which is embodied in our campus Principles of Community. UC San Diego embraces diversity, equity, and inclusion as essential ingredients of academic excellence in higher education

OUTCOMES (ABET accredited programs)

AEROSPACE ENGINEERING STUDENT OUTCOMES:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- An ability to communicate effectively with a range of audiences
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- An ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

MECHANICAL ENGINEERING STUDENT OUTCOMES:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
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- An ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

WHAT IS ABET?

ABET (Accreditation Board for Engineering and Technology)

All majors at US San Diego are accredited by the Western Association of Schools and Colleges (WASC). ABET is responsible for the specialized accreditation of educational programs in applied science, computing, engineering, and technology.

ABET accreditation is assurance that a college or university program meets the quality standards established by the profession for which it prepares its students. For example, an accredited engineering program must meet the quality standards set by the engineering profession. An accredited computer science program must meet the quality standards set by the computing profession.

The quality standards that a program must meet to be ABET-accredited are set by the ABET professions themselves. This is made possible by the collaborative efforts of many different professional and technical societies. These societies and their members work together through ABET to develop the standards, and they provide the professionals who evaluate the programs to make sure they meet those standards.

The Mechanical Engineering (B.S.) program is accredited by the Engineering Accreditation Commission of ABET, under the commission's General Criteria and Program Criteria for Mechanical Engineering and Similarly Named Engineering Programs.

The Aerospace Engineering (B.S.) program is accredited by the Engineering Accreditation Commission of ABET, under the commission's General Criteria and Program Criteria for Aerospace Engineering and Similarly Named Engineering Programs.

MAJOR ACADEMIC ADVISING

MAE Undergraduate Advising Staff

The MAE advising staff assists students with their programs of study.

*Please check the MAE website for all advising options.

The MAE advising staff also assists students in preparing petitions to the Undergraduate Affairs Committee for any deviation from the standard programs of study. It is important that the scheduling of mathematics, physics, chemistry and engineering courses be done as suggested in the MAE curriculum table. If you have any questions about your major, please see your MAE advisor.

GENERAL EDUCATION/COLLEGE REQUIREMENTS

For graduation, each student must satisfy general education (GE) course requirements determined by the student's college as well as the major requirements determined by the department. The eight colleges at UC San Diego require widely different general education courses and the number of such courses differs from one college to another. Each college is unique in terms of student culture and the breadth of general education.

Petitions to transfer between colleges are difficult to justify and are approved only in exceptional cases. To qualify, you must complete your originally assigned college's writing program, demonstrate that switching to a different college will substantially shorten your time to degree, and have a cumulative grade point average of at least 2.5 with a certain number of completed units. For more information about this, please contact your college advisor.

Each MAE program allows for general education courses so that students can fulfill their college requirements. In the ABET accredited programs, students must develop a program that includes a total of at least twenty-four units in the arts, humanities, and social sciences.. Some colleges require more than the nine or ten GE courses indicated in the curriculum tables. Accordingly, students in these colleges could take longer to graduate than four years. Students must consult with their college to determine which GE courses to take.

An approximate guide to the number of college general education courses in addition to those met within MAE major programs:		
	# of Courses	# of Units
Warren	10	40
Marshall	10-11	40-44
Muir	11	44
Sixth	12-14	52-60
ERC	10-15	44-64
Revelle	12-16	52-68
Seventh	14	56
Eighth	14	56

MAE MAJOR PROGRAMS AND REQUIREMENTS

Specific course requirements for each major program are outlined in this handbook. In addition to the required technical elective (TE) courses specifically indicated, a suggested scheduling of general education (GE) courses are distributed in the curricula for students to use to meet college general education requirements. **To graduate, students must maintain a 2.0 GPA in their lower-division course requirements and a 2.0 GPA in their upper-division course requirements. All students enrolled in MAE courses are expected to meet prerequisite and performance standards, i.e., students may not enroll in any MAE courses or courses in another department which are required for the major prior to having satisfied prerequisite courses with a D or better. The department requires at least a D grade in each course required for the major. This includes the required math, physics and chemistry courses. All courses required for the major must be taken for a letter grade and students will not graduate with more than one D grade in any course within their major. If a student has more than one D grade, it is their choice which course to repeat.** In the accredited programs, TE courses are restricted to meet ABET standards.

We STRONGLY discourage students deviating from their three/four-year plan when taking MAE upper-division courses.

Lower-division courses are offered more than once each year to allow students some flexibility in their scheduling. However, many MAE upper-division courses are taught only once per year, and courses are scheduled to be consistent with the curriculum as shown in the tables. Students taking upper-division courses in a different order than that shown in the tables may experience conflicts as the meeting times of different courses may overlap. **Courses with a letter grade of F must be repeated before you can move on to the next course in the sequence.** Prerequisites are strictly enforced.

SELECTIVE MAJORS

Due to high demand, most engineering majors at the Jacobs School have been designated as oversubscribed and have been granted selective status as of Fall 2014.

1. **Mechanical Engineering** (Effective Fall 2009 for freshmen. Effective Fall 2011 for transfers)
2. **Aerospace Engineering** (Effective Fall 2009 for freshmen. Effective Fall 2011 for transfers)

Acceptance into an Engineering Major

Acceptance into an engineering major is based on academic excellence demonstrated in high school, community college or other four-year institutions.

Admitted students that have applied to a selective major will be further evaluated by the Office of Admissions and Relations with Schools for admission to the major. Acceptance will be granted up to the maximum number of students in each of these selective major programs. Students who are not admitted to the selective major are placed into the alternate major selected on the UC Undergraduate Application, provided the alternate is not selective.

Students who would like to apply to switch into a selective MAE Engineering major must (1) complete at least one year of academic study at UC San Diego, (2) meet the minimum requirements to apply, and (3) submit an online application through the JSOE Selective Major Application system during an application period. For more information, please contact MAE Student Affairs.

AEROSPACE ENGINEERING

Aerospace engineering is a four-year curriculum that begins with fundamental engineering courses in mechanics, thermodynamics, materials, solid mechanics, fluid mechanics, and heat transfer. Additional courses are required in aerospace structures, aerodynamics, flight mechanics, propulsion, controls, and aerospace design. Graduates of this program normally enter the aerospace industry to develop aircraft and spacecraft, but also find employment in other areas that use similar technologies, such as mechanical and energy-related fields. Examples include automobile, naval, and sporting equipment manufacturing. This program received ABET accreditation in 2002.

This four-year plan is tentative and should be used as a guide.
Please refer to the MAE website for the most updated curriculum plan.

FRESHMEN FOUR YEAR PLAN

FALL QUARTER	WINTER QUARTER	SPRING QUARTER
Year 1		
Math 20A	Math 20B	Math 20C
MAE 2-Intro to Aerospace	Phys 2A	Phys 2B
Chem 6A	GE	GE
GE (College Requirement)	GE	GE
Year 2		
Math 18	Math 20D	Math 20E
Phys 2C + Phys 2CL	MAE 8 - MATLAB Programming for Engineering Analysis	MAE 131A - Solid Mechanics
MAE 21 – Aerospace Materials Science	MAE 30A – Statics and Intro to Dynamics	MAE 30B – Dynamics and Vibrations
GE	GE	TE (Technical elective)
Year 3		
MAE 11 - Thermodynamics	MAE 101B - Advanced Fluids	MAE 104 - Aerodynamics
MAE 101A - Intro to Fluids	MAE 143A - Signals and Systems	MAE 143B - Linear Control
MAE 105 - Intro to Mathematical Physics	SE 160A – Aerospace Structural Mechanics I	MAE 170 - Experimental Techniques
MAE 107 - Computational Methods in Engineering	TE	GE
Year 4		
MAE 113 - Propulsion	MAE 155A - Aerospace Design I	MAE 155B- Aerospace Design II
MAE 142 - Dynamics and Control of Aerospace Vehicles	MAE 175A - Engineering Lab	TE
TE	TE	GE
GE	GE	GE

WHEN SCHEDULING CLASSES, THE MAE DEPARTMENT FOLLOWS THIS CURRICULUM GRID. IF YOU CHOOSE TO DEVIATE FROM IT, YOU WILL EXTEND YOUR TIME TO GRADUATION.

TRANSFER THREE YEAR PLAN

AEROSPACE ENGINEERING		
FALL	**WINTER**	**SPRING**
Year 1		
MAE 2 -Intro to Aerospace	Math 20E	MAE 131A - Solid Mechanics
MAE 8 - MATLAB Programming for Engineering Analysis	MAE 30A – Statics and Intro to Dynamics	MAE 30B - Dynamics and Vibrations
MAE 21 – Aerospace Materials Science	GE – (College Requirement)	TE (Technical elective)
	GE	GE
Year 2		
MAE 11 - Thermodynamics	MAE 101B - Advanced Fluids	MAE 104 - Aerodynamics
MAE 101A - Intro to Fluids	MAE 143A - Signals and Systems	MAE 143B - Linear Control
MAE 105 - Mathematical Physics	SE 160A - Aerospace Structural Mechanics I	MAE 170 - Experimental Techniques
MAE 107 - Computational Methods in Engineering	TE	GE
Year 3		
MAE 113 - Propulsion	MAE 155A - Aerospace Design I	MAE 155B- Aerospace Design II
MAE 142 - Dynamics and Control of Aerospace Vehicles	MAE 175A - Engineering Lab	TE
TE	TE	GE
GE	GE	GE

This academic plan assumes that you have completed all of the following courses at your previous college:
Calculus I for Science and Engineering (MATH 20A), Calculus II for Science and Engineering (MATH 20B), Calculus and Analytic Geometry (MATH 20C), Differential Equations (MATH 20D), Linear Algebra [MATH 18], Complete calculus-based physics series (PHYS 2A, B, C), and general chemistry (CHEM 6A).

AEROSPACE ENGINEERING

In fulfilling the General Education (GE) requirements, students must take at least 24 units in the arts, humanities, and social sciences, not including subjects such as accounting, industrial management, finance, or personnel administration. Eight GE courses are listed here; individual college requirements may be higher or lower.

Technical Elective (TE) courses must be upper-division or graduate courses in the engineering sciences, natural sciences or mathematics and must be selected with prior approval of the Department. See the MAE website for a complete list of pre-approved Technical Electives.

Aerospace Engineering Specializations

Students will have the option to take four out of five technical electives from a list of pre-approved technical electives in a selected specialization in a particular topic. This optional specialization will show on the student's transcript and final degree. The specializations are:

- Astrodynamics and Space Applications
- Aerothermodynamics
- Flight Dynamics and Controls

MECHANICAL ENGINEERING

The Mechanical Engineering Program has a traditional ABET accredited four-year curriculum involving mechanics, vibrations, thermodynamics, fluid flow, heat transfer, materials, control theory and mechanical design. Graduates of this program find employment in the high-technology elector-mechanical industry as well as in the mechanical and aerospace industry.

This four-year plan is tentative and should be used as a guide.
Please refer to the MAE website for the most updated curriculum plan.

FRESHMEN FOUR YEAR PLAN

FALL QUARTER	WINTER QUARTER	SPRING QUARTER
Year 1		
Math 20A	Math 20B	Math 20C
Chem 6A	Phys 2A	Phys 2B
GE (College Requirement)	GE	MAE 3- Intro to Mechanical Design
GE	GE	GE
Year 2		
Math 18	Math 20D	Math 20E
Phys 2C	MAE 30A – Statics and Intro to Dynamics	MAE 131A- Solid Mechanics
MAE 20- Materials Science	MAE 8- MATLAB Programming for Engineering Analysis	MAE 30B- Dynamics and Vibrations
GE	GE	TE – (Technical Elective)
Year 3		
MAE 105 - Intro to Mathematical Physics	MAE 101A - Intro to Fluids	MAE 101B - Advanced Fluids
MAE 11 - Thermodynamics	MAE 143A - Signals and Systems	MAE 143B - Linear Control
MAE 40 - Linear Circuits	MAE 160 or MAE 131B	MAE 170 - Experimental Techniques
MAE 107 - Computational Methods	TE	GE
Year 4		
MAE 101C - Heat Transfer	MAE 156A - Mechanical Design I	MAE 156B - Mechanical Design II
MAE 150 - Computational Methods for Design	MAE 171A - Engineering Lab I	TE
TE	TE	GE
GE	GE	GE

WHEN SCHEDULING CLASSES, THE MAE DEPARTMENT FOLLOWS THIS CURRICULUM GRID. IF YOU CHOOSE TO DEVIATE FROM IT, YOU WILL EXTEND YOUR TIME TO GRADUATION.

TRANSFER THREE YEAR PLAN

MECHANICAL ENGINEERING		
FALL	**WINTER**	**SPRING**
Year 1		
MAE 3 - Intro to Mechanical Design	Math 20E	MAE 131A - Solid Mechanics
MAE 8 - MATLAB Programming for Engineering Analysis	MAE 30A – Statics and Intro to Dynamics	MAE 30B – Dynamics and Vibrations
MAE 20 - Materials Science	GE – (College Requirement)	TE - (Technical Elective)
	GE	GE
Year 2		
MAE 105 - Intro to Mathematical Physics	MAE 101A - Intro to Fluids	MAE 101B - Advanced Fluids
MAE 11 - Thermodynamics	MAE 143A - Signals and Systems	MAE 143B - Linear Control
MAE 40 - Linear Circuits	MAE 160 or MAE 131B	MAE 170 - Experimental Techniques
MAE 107 - Computational Methods	TE	GE
Year 3		
MAE 101C - Heat Transfer	MAE 156A - Mechanical Design I	MAE 156B - Mechanical Design II
MAE 150 - Computational Methods for Design	MAE 171A - Engineering Lab I	TE
TE	TE	GE
GE	GE	GE

This academic plan assumes that you have completed all of the following courses at your previous college:
Calculus I for Science and Engineering (MATH 20A), Calculus II for Science and Engineering (MATH 20B), Calculus and Analytic Geometry (MATH 20C), Differential Equations (MATH 20D), Linear Algebra [MATH 18], Complete calculus-based physics series (PHYS 2A, B, C), and general chemistry (CHEM 6A).

MECHANICAL ENGINEERING

In fulfilling the General Education (GE) requirements, students must take at least 24 units in the arts, humanities, and social sciences, not including subjects such as accounting, industrial management, finance, or personnel administration. Eight GE courses are listed here; individual college requirements may be higher or lower.

Technical Elective (TE) courses must be upper-division or graduate courses in the engineering sciences, natural sciences or mathematics and must be selected with prior approval of the Department. See the MAE website for a complete list of pre-approved Technical Electives.

Mechanical Engineering Specializations

Students will have the option to take four out of five technical electives from a list of pre-approved technical electives in a selected specialization in a particular topic. This optional specialization will show on the student's transcript and final degree. The specializations are:

- Controls and Robotics
- Fluid Mechanics and Thermal Systems
- Mechanics of Materials
- Materials Science and Engineering
- Renewable Energy and Environmental Flows (REEF)

ACADEMIC ENRICHMENT

Cooperative Education (Co-op)

The Cooperative Education (Co-op) Program is an immersive work experience in which students are employed full-time by a company for up to six months, which includes summer and one academic quarter, to supplement education with real-world experiences. Students with a minimum junior standing and a 3.0 GPA are eligible to apply. Positions are not guaranteed and students must apply and interview such as in any internship/job opportunity. For more information, please see the academic advisors.

Academic Internships: Special Study (MAE 197)

The UCSD Academic Internship Program coordinates work experiences for undergraduates with industry, government offices, and hospitals. Students work under the supervision of either a faculty member or an industrial supervisor. The position may or may not be salaried. Students may receive up to 12 units of academic credit by registering for MAE 197 Engineering Internship and completing a research paper or technical laboratory report on their internship work. The typical student time commitment to the internship is ten hours per week for every four units of academic credit. However, students may not receive upper division technical elective credit for such internships.

Undergraduate Research and Independent Study (MAE 199)

Undergraduates may participate in engineering research at UCSD through a number of informal and formal mechanisms. Many students first become familiar with research by participating 5-10 hours per week during the academic year or 10-20 hours per week in the summer on a volunteer basis.

Independent Study for Undergraduates (MAE 199) courses offer qualified and motivated students the opportunity to work closely with faculty and graduate students and gain firsthand experience in conducting research. MAE students may take MAE 199 under the guidance of an MAE faculty member. This course is taken as an elective on a P/NP basis. Under the following restrictive conditions, however, it may be used to satisfy upper-division technical elective course requirements for the major:

- The student must be in the major and have a GPA of **3.0** or better at the beginning of the MAE 199 project.
- The project must cover **two consecutive quarters** of work and the performance must be equivalent to A or B work, as determined by the 199 project advisor and the Undergraduate Affairs Committee. If the performance is not of A or B quality after the first quarter, the advisor can cancel the "contract" and the student may not attempt additional MAE 199 units.
- The two consecutive quarters of MAE 198/MAE 199 must total 8 units. 4 units for each quarter.
- The student must declare his intention to seek technical elective credit by filing out a Special Studies Form (each quarter) and an MAE 199 Contract (first quarter). These forms must be completed, approved, and processed by the beginning of the quarter in which the course is to be taken. Students cannot enroll in MAE 199 without first meeting with your 199 professor and submitting the Special Studies request via the online EASy portal.

The student, the MAE advisor, and the department chairperson must sign the contract. At the end of the first quarter, a progress report must be submitted to the advisor. The advisor may cancel the contract for less than B performance, assigning a grade of P or NP, as appropriate. These units will not count toward technical elective credit. At the end of the second quarter, the advisor will assign an internal letter grade based on the final written report and discussions with the student during the previous quarter. If the grade is less than a B, a grade of P or NP will be reported for the second quarter and no technical elective credit will be given. Otherwise, the final report must be submitted to the MAE department chair by the student at the end of the second quarter to determine if the student will receive technical elective credit. It is the students' responsibility to make sure that his/her 199 advisor gets the report turned in on time to the MAE department chair.

Opportunities Abroad

Engineering is a global field offering jobs throughout the world. You can prepare yourself for these opportunities with an exciting study or internship experience abroad. Through the Programs Abroad Office, students may receive credit for international study through a variety of programs. For information on these programs, first contact the Programs Abroad Office (858-534-1123) or visit the International Center on Library Walk.

Global Teams In Engineering Service (TIES)

Teams in Engineering Service is an innovative service-learning academic program putting UCSD undergraduates and their technical and creative skills to work for San Diego non-profit organizations. Multi-disciplinary teams of UCSD students design, build, and deploy projects that solve technology-based problems for community partners.

TIES projects can range from working with orthopedists and physical therapists to developing and building mechanical tools or prosthetics for the developmentally disabled and to working with agriculture to develop new irrigation solutions for local farming communities.

The benefits for student's involvement in TIES are numerous, and include improved communication, organizational, and leadership skills, start-to-finish design experience, multidisciplinary teamwork, experience in project and resource management, ethics training and responsibility, as well as customer and community awareness. Finally, TIES provides demonstrable and measurable outcomes of undergraduate engineering theoretical knowledge, technical skills, teamwork, communication, ethical responsibility and value for professional development. MAE students are eligible to receive 4 units of technical elective.

TIES Project - Middle School Environmental Education

TIES Project- The Free Clinic Project: Electronic Medical Records

Team Internship Program (TIP)

Today's employers are looking for engineers who have both technical skills and the ability to collaborate and function as a team. Summer Team Internships are part of the Jacobs School of Engineering's effort to enhance our students' education through real-world engineering experiences in a team setting. Students work on-site with local, domestic, and international industry partners as a multi-disciplinary team of 2-5 students, focused on a clearly defined and significant project. TIP is a 10-12 week, full time, paid internship program during the summer.

Undergraduate and graduate students of all levels in all engineering departments are eligible to apply. All applications and resumes are screened by the TIP Office and candidates who best meet the criteria are forwarded to companies for review.

TIP also offers resume guidance and professional development training to all applicants. This is designed to help students make the best impression at their interviews. TIP, in collaboration with the Corporate Affiliates Program (CAP), works with some of the top engineering companies. Many TIP students are offered full time employment upon finishing their internship.

Participating Companies


IDEA CENTER

The Jacobs School of Engineering supports several programs that promote academic and professional development for undergraduate students across all engineering departments. These include:

- **Engineering Student Organizations**
- **Jacobs Undergraduate Mentoring Program (JUMP)**
- **Success Workshops for Emerging Engineers in Training (SWEET)**
- **Internship Programs**
- **Tutoring**

Student Societies and Organizations

The Undergraduate Student Advisory Committee (USAC) is a group of undergraduate students consisting of representatives from the MAE Department. The representatives are selected/appointed by the students each year. The group meets with the Undergraduate Affairs Committee (UAC) Chair on a semi-annual basis. The group discusses all aspects of student life with a focus on the undergraduate programs in MAE. The concerns and suggestions communicated by USAC are presented to the faculty and administration for consideration. USAC also provides a link to the student professional and honor societies that are active in the Jacobs School of Engineering (JSOE). These societies include AIAA, ASME, AIChE, SAE, SWE, and Tau Beta Pi.

The **Center for Student Involvement** coordinates the formation of student clubs that are run by and for students. All of these groups are represented at the Fall Festival on the Green (FFOG), usually held in mid-October. Call (858) 534-0501 or email getinvolved@ucsd.edu for further information.

MAE undergraduate students participate in student chapters of the American Institute of Aeronautics and Astronautics (AIAA), American Society of Civil Engineers (ASCE), and American Society of Mechanical Engineers (ASME). These student chapters invite external speakers, organize trips to local companies, visit local projects and participate in regional and national design competitions.

A number of other engineering societies are active at UCSD. The Society of Women Engineers (SWE) encourages and supports women in engineering. They sponsor talks, provide workshops, and distribute information about opportunities for women in engineering. The Society of Hispanic Professional Engineers (SHPE) promotes the development of Hispanics in engineering, science, and math to achieve educational excellence, economic opportunity, and social equity. The National Society of Black Engineers (NSBE) provides a forum of support for African-American engineers. Each year, NSBE, SWE, and SHPE sponsor a Night of Industry, designed to inform undergraduate minority engineers of industrial opportunities. Tau Beta Pi (TBP) at UCSD is a member of the National TBP engineering honor society. Engineering students who rank in the top 1/8 of juniors and the top 1/5 of seniors are contacted by TBP for possible membership. These students are eligible for membership in TBP if they complete an interview process as well as a community service project. Throughout the year, TBP invites speakers to club meetings, organizes tours of companies, and provides a tutoring service.

Engineering Student Employment Opportunities

In a coordinated effort, the IDEA Center assists Career Services, the Academic Internship Program, interested companies, and faculty and staff in disseminating information about job opportunities for engineering students. These opportunities include permanent employment, part-time employment during the academic year, summer employment and contract work. If you have additional questions about this service, you may contact the coordinator at idea@ucsd.edu or by phone at (858) 534-6105.

Getting Experience

The Jacobs School of Engineering is located at the heart of San Diego's thriving technology and life sciences industry, and career opportunities abound for our students. Engineering students make connections with prospective employers through the following resources:

CAP Resume Database: Students gain an insider advantage by posting their resumes to the CAP (Corporate Affiliates Program) Resume Database. Our 50+ industry partners can access student resumes online via this members-only searchable database.

Career Center: The Center is a one-stop shop for career exploration, resume development, grad school preparation, career fairs, and Port Triton job postings. Students seeking internships or full-time jobs can sign up for interviews on campus with selected employers.

Student Organization Career Networking: Our student organizations invite companies to campus for recruitment and networking activities geared towards specific engineering disciplines. The Triton Engineering Student Council's (TESC) annual Disciplines of Engineering Career Fair (DECaF) draws more than 70 companies and 1,500 attendees.

Academic Internship Program (AIP): Students can earn academic credit for internships through the UCSD AIP program. Internships are available locally, nationally, and via specific programs in New York City (NY), Washington (D.C.), Sacramento (CA), London (England), and Sydney (Australia).

ACADEMIC SUPPORT

OASIS (Office of Academic Support and Instructional Services)

The Office of Academic Support and Instructional Services (OASIS) provides a variety of services to maximize student performance and retention at UC San Diego. OASIS provides free activities that support and contribute to the improvement of teaching and learning. Programs range from services to help students overcome past academic inefficiencies to programs that help them excel in a subject matter or skill. All students in any of the seven colleges are eligible for OASIS programs. Classes are non-credit and may be repeated. Course titles and schedules can be found on the OASIS website. Professional and peer counselors assist in all areas with adjustment to university life. Tutors are available on a drop-in basis to help the student become an independent learner. Tutors often arrange to hold group sessions in various locations throughout campus. For more information: Center Hall, 3rd Floor, Tel. 534-3760.

Teaching + Learning Commons

UC San Diego's Teaching + Learning Commons consists of six hubs (Academic Achievement, Digital Learning, Education Research + Assessment, Engaged Teaching, Experiential Learning, Writing), which offer a wide range of programs, services, and research to assist all members of the UC San Diego community in developing learning environments and experiences that encourage engagement and foster student success.

OPPORTUNITIES FOR UNDERREPRESENTED STUDENTS

The **Academic Enrichment Programs (AEP)** office manages several programs to help underrepresented undergraduate students prepare for graduate school and careers in research and college teaching. These activities complement the OASIS Academic Transition Program and Student Support Services in the Jacobs School of Engineering.

The **McNair Program** serves low-income, first-generation college students and under- represented minorities who are interested in pursuing a Ph.D. It is a one-year rigorous program of scholarly activities that includes participation in the Faculty Mentor Program and the Summer Research Program. In addition, participants receive training in how to write and present a scholarly paper, preparation for the GRE, and assistance with the graduate school application process. All participants have the opportunity to present a paper at a minimum of two research conferences.

The **Summer Research Program (SRP)** offers full-time research experience to underrepresented students (i.e., minorities, women, and low-income, first generation college students) who are interested in preparing for careers in research or university teaching. As research assistants, students work on their faculty mentor's project for at least 30 hours per week. Students are trained in research skills, how to write and present a research proposal or paper, and how to prepare for the GRE. At the conclusion of the program, students present their papers at the UCSD Summer Research Conference. Students who participate in this intensive 8-week program may receive free on-campus housing, 4 units of MAE 199 (Independent Study) credit, and stipends. Eligible students are juniors and seniors who have a 3.0 GPA or above and plan to attend graduate school.

The **Undergraduate Research Conference (URC)** is an annual event where more than 100 students who have written outstanding research papers are invited to present their research. Invitation is by faculty nomination. Students present their papers at small round table discussions led by a faculty. Conference participants receive a certificate as a research scholar.

The **Faculty Mentor Program (FMP)** offers invaluable research experience to all junior or seniors with a GPA of 2.7 or higher who have the desire to prepare for graduate or professional school. This program is an excellent way to get to know and work with a UC San Diego faculty mentor for two quarters. It is great preparation for graduate and professional school. All students who complete the FMP application and meet the eligibility requirements may participate if a suitable research placement can be arranged.

ETHICAL STANDARDS OF THE ENGINEERING STUDENT

The UC San Diego Policy on Integrity of Scholarship states the general rules for student integrity.

Instructor's Responsibility
At the beginning of the term the instructor shall state in writing (e.g., in the syllabus, information sheets, or website) what graded assignments and exams will be required of students. If there are any course-specific rules required by the instructor for maintaining academic integrity, the instructor shall also inform students in writing what kinds of aid and collaboration, if any, are permitted on graded assignments and exams.

Student's Responsibility
Students are expected to complete the course in compliance with the instructor's standards.
No student shall engage in an activity that involves attempting to receive a grade by means other than honest effort; for example:

- No student shall knowingly procure, provide, or accept any unauthorized material that contains questions or answers to any examination or assignment to be given at a subsequent time. THIS INCLUDES SOLUTIONS MANUALS.
- No student shall complete, in part or in total, any examination or assignment for another person.
- No student shall knowingly allow any examination or assignment to be completed, in part or in whole, for himself or herself by another person.
- No student shall plagiarize or copy the work of another person and submit it as his or her own work.
- No student shall employ aids excluded by the instructor in undertaking course work or in completing any exam or assignment. THIS INCLUDES SOLUTIONS MANUALS.
- No student shall alter graded class assignments or examinations and then resubmit them for regrading.
- No student shall submit substantially the same material in more than one course without prior authorization.

Students are expected to notify their instructor or appropriate officials, such as their college Dean, about any incident of dishonesty they observed.

JACOBS SCHOOL STUDENT HONOR CODE

We, the members of the Jacobs School of Engineering, have a responsibility as students, faculty and staff to ensure the highest level of integrity in our academic and social practices.

As Jacobs School engineering students, we are creating the foundation for our futures as engineers. We must look to pursue knowledge justly, fairly, and honestly. The value of our education is in understanding that learning is a lifelong commitment. The experiences that we share and the skills that we learn are all the more valuable if we hold ourselves to high ethical and moral standards.

The Jacobs School must promote leadership, honesty and integrity. The Jacobs School community must work together to ensure that these qualities are valued. We must also make a conscious effort to provide our students with the instruction that will prepare them for a professional career. Instructors will honor their teaching responsibilities, and in turn students will reflect this commitment by pursuing leadership, honesty and integrity in their own academic endeavors.

This is a personal and professional commitment that we all share as members of the Jacobs School of Engineering. We pledge ourselves to these ideals and promise to be honest in our hearts, minds and our actions.

- Triton Engineering Student Council, 2003

PROFESSIONAL ENGINEERING (PE) LICENSE

Whether you design power plants, consumer goods, buildings, or aerospace vehicles, whether you work in private industry, for the U.S. government, or for the public and whether your efforts are theoretical or practical, you (as an engineer) have a significant responsibility.

Engineers of all types perform exciting and rewarding work, often stretching new technologies to their limits. But those limits are often incomprehensible to non-engineers. As the ambient level of technological sophistication increases, the public depends increasingly and unhesitatingly on engineers. That is where professional licensing and the National Society of Professional Engineers (NSPE) become important.

NSPE, the leading organization for licensed engineering professionals, is dedicated to serving the engineering profession by supporting such activities as continuing educational programs for its members, lobbying and legislative efforts on local and national levels and promoting guidelines for ethical service. From local, community-based projects that encourage top-scoring high school students to choose engineering as a career, to hard-hitting lobbying efforts in the nation's capital to satisfy the needs of all engineers, NSPE is committed to you and your profession.

Engineering licensing is a two-way street: it benefits you while it benefits the public and the profession. For you, licensing offers a variety of advantages, ranging from peer recognition to greater advancement and career opportunities. If you wish to become an *independent engineering consultant*, it is required by law that you are registered. Some states require registration as a Professional Engineer if you wish to use the title engineer. A court of law generally will not recognize an individual as an engineer unless he/she is registered, thus one cannot testify as an expert witness or try to collect engineering fees unless one is registered. For the profession, licensing establishes a common credential by which engineers can be compared. For the public, a professional engineering license is an assurance of a recognizable standard of competence.

The requirements for professional engineering registration prevailing in most of the states are as follows:

1. Graduation from an ABET accredited school, plus four years of engineering experience acceptable to the board, plus passage of a 16-hour written examination, or
2. Eight years of engineering experience acceptable to the board, plus passage of a 16-hour written examination.

The 16-hour written examination is divided into two equal parts: the first is generally known as the "Fundamental Examination" (sometimes referred to as the "Engineering-in-Training" exam or the EIT) and the second, as the "Professional Examination," (sometimes referred to as the PE exam or the "Principles and Practices" exam). Persons who successfully pass these examinations are entitled to use the title "Professional Engineer" and to place the initials "P.E." after their names. It is illegal for unregistered persons to use the title.

Nearly all states have made provisions for an EIT status and will allow persons to take the first eight-hour (EIT or "Fundamentals") portion of the written examination immediately before or immediately after graduation from an ABET accredited school. EIT status conveys no legal privileges and is offered primarily as a convenience to new graduates so that they can take the examination in fundamentals at a time when the material is still fresh in their minds. Almost all of the states use a uniform national EIT examination, administrated through the National Council Engineering Examiners (NCEE) and a great majority uses a uniform national examination for the "Professional" portion.

The 8-hour EIT exam, which is generally offered twice a year (April, October), is a closed-book exam (calculators allowed) that consists of two four-hour sessions separated by a one-hour lunch. The morning session has 140 multiple choice questions covering such topics as: chemistry, electric circuits, mathematics, statistics, dynamics, mechanics, material science, thermodynamics, engineering economics, fluid mechanics. Since all 140 morning problems must be worked to get full credit, it is important that you know all subject areas and have strategy that involves fast recall (memorize formulas, solution procedures, important data) and stamina. The afternoon session consists of 70 questions in 5 topics engineering mechanics, applied mathematics, electrical circuits, and engineering economics and thermo/fluid mechanics. No material of any kind will be allowed. A reference handbook will be furnished at the exam site and will be collected at the conclusion of the examination.

For application and further information regarding the California EIT and PE examinations contact:

State Board of Registration for Professional Engineers and Land Surveyors
2535 Capitol Oaks Drive, Suite 300
Sacramento, California 95833-2944

or call (866) 780-5370, or visit their website: https://www.bpelsg.ca.gov/

For more information regarding Professional Engineering membership, call (703) 684-2800, or visit their website: https://www.nspe.org/

Degrees Required

A bachelor's degree in engineering is generally required for entry-level engineering jobs. Engineering degrees from one area may be able to work in related areas. For example, many aerospace engineers have training in mechanical engineering. This flexibility allows engineers to shift in fields. Graduate training is essential for engineering faculty positions but is not required for the majority of entry-level engineering jobs. Many engineers obtain graduate degrees to learn new technology, broaden their education, and enhance their promotional opportunities.

It is important for engineers to continue their education throughout their careers because much of their value to their employer relies on their knowledge of current technologies.

Source: Bureau of Labor Statistics

Preparation for Graduate Studies

Many engineers, after receiving their Bachelor's degrees choose to continue their education and training by enrolling in graduate programs leading to the Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) degrees in Engineering. A Ph.D. degree is required for research and teaching at the college and university level.

General information on graduate schools can be obtained from the MAE graduate advisor and through the Professional and Graduate School Advising Office of the Career Services Center (career.ucsd.edu). The Career Center has the current edition of *Peterson's Guide to Graduate Schools*, which contains information on Graduate Engineering Programs. Also, the Career Center has information on the Graduate Record Examinations (GRE), typically taken in spring of junior year or fall of senior year. In addition, the Career Center coordinates the distribution of letters of recommendation to graduate schools.

Admission to graduate schools of engineering is typically based on undergraduate GPA (a minimum of 3.0 is typically required), GRE scores, letters of recommendation from faculty, reputation of undergraduate institution and additional research or professional activities of the applicant. Applications are typically due at the end of December or the beginning of January for admission to the fall quarter or semester.

The most common form of financial aid for academic doctoral study is a departmental assistantship (teaching or research), in addition to some form of tuition remission or waiver (partial or full) by the institution or department. Most research university doctoral programs attempt to fund students throughout their Ph.D. programs. External fellowships (e.g., NSF Fellowship, Ford Foundation Fellowship) or other competitive awards sometimes augment institutional aid. Funding for academic masters' programs generally varies from none to partial to full funding; however, many masters students must fund all or part of their graduate education.

MAE FACULTY

Name	Phone (858)	Email: @ucsd.edu	Research Area/s
Anderson, Mark	822-7939	m3anderson	**Design/Engineering Education/Aerospace**
Arefiev, Alexey		aarefiev	**Plasma & Fusion**
Bandaru, Prabhakar	534-5325	pbandaru or prab	**Energy / Solid Mechanics and Materials Science**
Becker, Janet		jmbecker	
Beg, Farhat	822-1266	fbeg	**Energy**
Bewley, Tom	534-4287	tbewley	**Design/ Dynamic Systems & Control**
Boechler, Nicholas	534-2563	nboechler	
Cai, Shengqiang	534-2372	shqcai	**Solid Mechanics and Materials Science**
Chen, Renkun	534-2433	rkchen	**Energy/ Environmental Engineering**
Coimbra, Carlos	534-4285	ccoimbra	**Energy / Environmental Engineering**
Cortes, Jorge	822-7930	cortes	**Dynamic Systems & Control**
Davidson, Michael		mrdavidson	
de Callafon, Raymond	534-3166	callafon	**Design/Dynamic Systems & Control**
Delson, Nate	534-0655	ndelson	**Design/Engineering Education/Robotics/Mechanical Devices**
Diagne, Mamadou		mdiagne	**Dynamic Systems & Control**
Frazier, Michael		mjfrazier	**Mechanics & Materials**
Garay, Javier	534-4903	jegaray	**Mechanics & Materials**
Ghazinejad, Maziar	534-5832	mghazinejad	
Graeve, Olivia	246-0146	ograeve	**Solid Mechanics and Materials Science**
Gravish, Nicholas		ngravish	**Robotics and Design**
Hao, Xuanting		x3hao	**Fluid Mechanics**
Herbert, Sylvia		sherbert	
Hidalgo-Gonzalez, Patricia		phidalgogonzalez	
Hwang, John	246-3070	jhwang	
Kleissl, Jan	534-8087	jkleissl	**Energy/ Environmental Engineering/ Fluid Mechanics, Combustion and Engineering Physics**
Kramer, Boris	246-5327	bmkramer	**Fluid Mechanics**
Krasheninnikov, Sergei	822-3476	skrashen	**Energy**
Krstic, Miroslav	822-1374	mkrstic	**Dynamic Systems & Control**
Lal, Ratnesh	822-0384	rlal	
Lindsey, Stephanie	822-3744	stlindsey	

Llewellyn Smith, Stefan	822-3475	sgls	**Environmental Engineering/ Fluid Mechanics, Combustion and Engineering Physics**
Luan, Haiwen		h2luan	
Lubarda, Marko		mlubarda	
Lucas, Andrew	822-2580	ajlucas	
Marinoni, Alessandro		amarinoni	
Martinez, Sonia	822-4243	soniamd	**Dynamic Systems & Control**
McEneaney, William	822-5835	wmceneaney	**Dynamic Systems & Control**
Meyers, Marc	534-4719	mameyers	**Solid Mechanics and Materials Science**
Miller, David	534-3182	dmiller	**Fluid Mechanics, Combustion and Engineering Physics**
Morimoto, Tania	534-1375	tamorimoto	
Nesterenko, Vitali	822-0289	vnesterenko	**Solid Mechanics and Materials Science**
Nomura, Keiko	534-5520	knomura	**Environmental Engineering/ Fluid Mechanics, Combustion and Engineering Physics**
Pawlak, Geno	534-2343	epawlak	**Fluid Mechanics, Combustion and Engineering Physics**
Pisano, Al	534-6237	appisano	**Design, Mechanics and Materials**
Poulikakos, Lisa		lpoulikakos	
Qi, Huihui		huqi	
Rosengren, Aaron		arosengren	
Saha, Abhishek		asaha	
Saintillan, David	534-2415	dsaintillan	**Fluid Mechanics and Heat Transfer/ Biomechanics**
Sanchez, Antonio	822-3790	alsp	**Fluid Mechanics and Heat Transfer/ Combustion**
Sarkar, Sutanu	564-8243	ssarkar	**Fluid Mechanics, Combustion and Engineering Physics**
Seshadri, Kalyanasundaram	534-4876	kseshadri	**Energy**
Scholtes Acevedo, Claire		cscholtesacevedo	
Schmidt, Oliver	246-5818	oschmidt	**Fluid Mechanics**
Tolley, Michael	534-1355	tolley	**Dynamic Systems and Control, Design,**
Tynan, George	534-9724	gtynan	**Energy**

Advising

What is the difference between college and department advising?

Each undergraduate student at UC San Diego has advisors in their academic department as well as in their college. MAE advisors are department specialists rather than generalists.

MAE Academic Advising
The MAE advisors help students with major curriculum planning, petitions for MAE coursework, department regulations, degree checks, etc. Department advisors can also refer students to faculty for advice on engineering specializations, technical electives and career options.

College Advising
College advisors assist students in understanding their GE and University graduation requirements. They can help students understand policy and procedures, develop personalized educational strategies, and serve as specialists in the college-specific general education requirements.

How do I make an appointment to meet with an MAE Academic Advisor?

Please check the MAE website for all advising options.

What are the GE courses on my three/four-year plan?

The GE courses listed on your major curriculum are simply there to help you plan your college general education courses accordingly. Please see your college advisor for more information regarding your required GE courses.

Can I switch from my current college to another college?

Yes, but only after you have completed your college's writing program and if you can demonstrate that switching to a different college will allow you to graduate in fewer academic quarters. In practice, the overwhelming majority of students are happy with their college assignment, even if it was not their first choice originally, and few students apply to switch. Please contact your current college for more information.

Academic History

If I received AP credit for a lower-division math or science course required for my major, do I have to retake the course?

No. If you received AP credit for a course, such as Math 20A or Physics 2A, you do not have to take the class again. We advise that you continue with the series as prescribed in your curriculum. Please double check with the respective department and make sure that you know which classes you are exempt from taking. Credit for Math 10A or Physics 1A is not the same as Math 20A or Physics 2A. Credit for Math 10A DOES NOT exempt you from Math 20A.

How do I determine if my major department has received my transcripts/AP scores?

Your major department does not handle, receive or evaluate your transcripts. If you have questions about your transcripts or AP scores, please contact the Admissions Office. Otherwise, please keep checking to make sure that all courses you have taken at your previous community college/university have transferred in by checking your "Academic History" via TritonLink.

How will I know which courses have transferred to UC San Diego?

The website Assist.org is a useful tool for determining transfer course equivalency between UCSD and California community colleges. You can also check which of your transfer courses successfully transferred in by checking your "Academic History" or "Degree Audit" via TritonLink.

I took a course at my community college/university that is similar to a course at UC San Diego but it is not articulated in my Academic History. What should I do?

Some engineering courses from a community college or other university do not automatically transfer to UCSD. For MAE courses, you will need to petition for equivalency of this course with a particular MAE course. For the MAE Department, a course substitution petition must be submitted through the MAE Undergraduate Online Petition Portal:

- **Check with Assist.org** to see if a course equivalency already exists between the transfer course and MAE course. If so, then you will not need to petition but instead just let the advisors know.
- **Fill out a "course substitution" petition** using the MAE Online Undergraduate Petition Portal.
- **Attach documentation of transfer course work** to your petition (e.g., detailed syllabus, title of textbook, lecture notes, and exams).
- **Submit** your petition.

Your petition will be reviewed by an MAE faculty member. The faculty might require more information from you about the course (e.g., lecture notes) in order to make a decision. It is not guaranteed that they will be able to judge whether or not a transfer course is equivalent to an MAE course if you are not able to provide sufficient coursework.
You will be notified of the petition decision through the Virtual Advising Center (VAC). If the transfer course is determined to be equivalent, then your Degree Audit will be updated to reflect this. The enrollment system cannot read manual exceptions to the degree audit so if you encounter any issues, please submit an EASy request. DON'T WAIT UNTIL YOUR REGISTRATION DATE AS YOU MAY END UP ON A WAITLIST!

My transfer academic history is incorrect on my Triton Link. Who should I speak to about correcting my academic information?

Sometimes, transferable course numbers are listed incorrectly in the Academic History section in TritonLink. You will most likely run into this problem if you completed a series, such as the Physics series, at two or more community colleges.

A MAE Advisor can fix only MAE-transferable courses. For math and science course corrections, please see that specific department (e.g., for a Math course see the Math Department). An error like this will keep you from enrolling into other MAE courses.

Enrollment

When can I enroll in classes? How do I enroll in my classes?

Your enrollment time and date will be posted on WebReg. If you need help finding your registration time or need help with enrollment, please review the WebReg tutorial.

What is two-pass enrollment?

The campus has a two-pass enrollment process for all undergraduate students that allows you to "pass" through the enrollment process twice before enrolling in your full course load for any given quarter.

How the two-pass enrollment system works: All students are assigned TWO enrollment times and dates appointments. Please check TritionLink for your enrollment times and dates.

FIRST PASS (48 hour window):

- You may ENROLL in up to 11.5 units.
- You will be UNABLE TO WAITLIST in courses during the first pass.
- You will have 48 HOURS to complete your enrollment during the 1st pass.
- Students who do not enroll during their 1st pass appointment must WAIT UNTIL THE 2ND PASS to enroll.

SECOND PASS

- You may ENROLL IN UP TO 19.5 units.
- You may WAITLIST for courses during the 2nd pass.
- Once your 2nd pass enrollment has started you can add classes until Week 2 of the quarter.

How do I prioritize my enrollment?

Many students are unsure about which courses to enroll in during their first pass. The following information is intended to offer some general guidance. During your first enrollment pass, it is recommended you prioritize your enrollment based on the following criteria:

- Courses required for your major.
- Courses that are prerequisites for courses you intend to take in subsequent quarters.
- Infrequently offered courses, such as those offered only once a year or in alternate academic years.
- Small courses with limited seats, such as labs, e.g., MAE 3, MAE 170, etc.

How to prepare for your enrollment appointment.
1. Determine which courses you want to enroll in prior to your enrollment appointment.
2. Check to see that you have satisfied the necessary prerequisites to enroll.
3. Have back-up options in the event the course you want to take is full.
4. Speak with your department and college advisor prior to your enrollment time for further assistance.
5. If you petitioned for transfer equivalency with an MAE course and it is a prerequisite, please submit an EASy request. Don't wait until your registration date as you may end up on a waitlist!

What if the class I want to add is full?

If a class you hope to add is full, add yourself to the waitlist during your second-pass enrollment period. Please note that you cannot waitlist for any course during your first pass. If you need to take the course that quarter to graduate on time, you might receive an email from MAE Advising with instructions for overriding the waitlist. If you receive this email, you must drop yourself from the waitlist and add the course again. Other than this, the waitlist sequence is first-come, first-served. Be sure to enroll during your appointment time! An automated computer program will move eligible students off the waitlists and into classes as seats become available. It will run nightly through the end of the second week of the quarter.

Keep in mind that classes fill up fast during the initial registration period. During the first week of the quarter, students will start to drop courses as they readjust their schedules, opening spaces in the courses. Once space is available, waitlisted students will automatically be enrolled in the course.

Are all MAE courses offered every quarter?

No. Some courses are offered only once a year. If you miss taking that course in the quarter that it's offered, you may have to wait a year to take it. A complete schedule of courses offered for this year is located both in the MAE lobby and on the MAE website.

TritonLink won't let me enroll in a class. It says I don't meet the prerequisites. What should I do?

If you have above a 3.0 GPA and have the prerequisites, please submit an Enrollment Authorization System (EASy) request so that the MAE department can check into this. Please see the MAE prerequisite petition policy here. If you are trying to add a course in a different department, please contact that specific department. (EX: For a course in Computer Science and Engineering, please contact the CSE Department).

Selective Major

What if I want to switch majors?

If your desired major is not selective, you can switch to that major on your student portal on TritonLink. **If you plan to switch to a selective major, please contact that department for more information.**

What is a Selective Major?

A selective major is one in which demand for that major outweighs available resources to meet the demand. As of Fall 2009, Mechanical and Aerospace Engineering became selective majors. This means that students will have to apply to declare these majors and admission is not guaranteed.

Other

Which computer/ laptop should I buy?

Computer choice for students is a moving target, with the rapid changes in technology. The university provides computers in the labs and libraries but many students find benefits in having their own computers. Many students like the portability and long battery life of notebooks. These lower cost computers can run some engineering software such as Matlab, but they typically will not run Autodesk Inventor and ProE, which MAE students do use. One solution is to have both a notebook and a higher-powered laptop or desktop at home. One can use an Apple computer, but with a partition to run Windows programs, such as Inventor, ProE, and Labview. The computer requirements for Autodesk Inventor can be found at: http://www.autodesk.com/education/home. Students will be using Fusion360, MATLAB, and Arduino pretty extensively, with the possibility of using SolidWorks for extracurriculars.

Which engineering organizations can I get involved in as an engineering student?

Our engineering student organizations help students develop their leadership skills and connect with the Jacobs School of Engineering community. Activities range from professional development and career networking to project teams, design competitions and K-12 outreach. For a list of engineering student organizations that you can be involved in, please visit here: https://jacobsschool.ucsd.edu/idea/current-undergraduates/undergraduate

MAE COURSE DESCRIPTIONS

2025-2026

Please refer to the Schedule of Classes for the most up-to-date course information and prerequisites.

Lower Division

MAE 02. Introduction to Aerospace Engineering (4)

An introduction to topics in aeronautical and astronautical engineering including aerodynamics, propulsion, flight mechanics, structures, materials, orbital mechanics, design, mission planning, and environments. General topics include historical background, career opportunities, engineering ethics, and professionalism. *Prerequisites:* none.

MAE 03. Introduction to Mechanical Design (4)

Introduction to design process through hands-on individual and team projects. Topics include 2D/3D CAD (drawing projections/isometrics, dimensioning), design problem identification, prototype fabrication techniques (shop skills, rapid prototyping), design process (concept generation/selection, risk reduction strategies, scheduling), learning from hardware performance (problem solving/redesign), teamwork. Use of components: fasteners, couplings, DC motors, oral/written communication with graphics. Program or materials fees may apply. *Prerequisites:* PHYS 2A or 4A. Enrollment restricted to BE 25, MC 25, MC 27, MC 29, and MC 30–37 majors only.

MAE 05. Quantitative Computer Skills (4)

Introductory course for nonengineering majors. Use of computers in solving problems; applications from life sciences, physical sciences, and engineering. Students run existing computer programs and complete some programming in BASIC. *Prerequisites:* none.

MAE 07. Spatial Visualization (1)

(Cross-listed with SE 7.) Spatial visualization is the ability to manipulate 2-D and 3-D shapes in one's mind. In this course, students will perform exercises that increase their spatial visualization skills. P/NP grades only. Students may not receive credit for SE 7 and MAE 7. *Prerequisites:* none.

MAE 08. MATLAB Programming for Engineering Analysis (4)

Computer programming in MATLAB with elementary numerical analysis of engineering problems. Arithmetic and logical operations, arrays, graphical presentation of computations, symbolic mathematics, solutions of equations, and introduction to data structures. *Prerequisites:* MATH 20A and 20B or consent of instructor.

MAE 11. Thermodynamics (4)

Fundamentals of engineering thermodynamics: energy, work, heat, properties of pure substances, first and second laws for closed systems and control volumes, gas mixtures. Application to engineering systems, power and refrigeration cycles, combustion. Renumbered from MAE 110A. Students may not receive credit for MAE 11 and MAE 110A. *Prerequisites:* PHYS 2C and CHEM 6A. Enrollment restricted to engineering majors only.

MAE 20. Elements of Materials Science (4)

The structure of materials: metals, ceramics, glasses, semiconductors, superconductors, and polymers to produce desired, useful properties. Atomic structures. Defects in materials, phase diagrams, microstructural control.

Mechanical and electrical properties are discussed. Time temperature transformation diagrams. Diffusion. *Prerequisites:* PHYS 2A or 4A, CHEM 6A or CHEM 6AH, and MATH 20C.

MAE 21. Aerospace Materials Science (4)

Atomic structure and physical properties of engineering materials including metals, ceramics, glasses, polymers, and composite materials. Defects and phase diagram of materials. Material testing and processing. Program or materials fees may apply. *Prerequisites:* PHYS 2A or 4A, CHEM 6A or CHEM 6AH, and MATH 20B. Enrollment restricted to MC 25 and MC 35–37 majors only.

MAE 30A. Statics and Introduction to Dynamics (4)

Statics: statics of particles and rigid bodies in 3-D. Free body diagrams. Moment of a force, couples, equivalent systems of forces. Distributed forces, centroids, and centers of gravity. Introduction to dynamics: 3-D relative motion, kinematics, and kinetics of particles. Newton's equations of motion. Equilibrium problems with friction. Enrollment restricted to engineering majors MC 25, MC 27, MC 29, MC 30–34, MC 35–37, and SE 27. *Prerequisites:* PHYS 2A and MATH 31BH or MATH 20C.

MAE 30B. Dynamics and Vibrations (4)

Dynamics: energy methods for motion of particles and rigid bodies, including virtual work, power, and Lagrange's equations. Impact and impulses. Systems of particles. Introduction to 3-D dynamics of rigid bodies. Introduction to vibrations: free and harmonically forced vibrations of undamped and damped single degree of freedom systems. Enrollment restricted to engineering majors only MC 25, MC 27, MC 29, MC 30–34, MC 35–37, and SE 27. *Prerequisites:* MAE 30A.

MAE 40. Linear Circuits (4)

Steady-state and dynamic behavior of linear, lumped-parameter electrical circuits. Kirchhoff's laws. RLC circuits. Node and mesh analysis. Operational amplifiers. Signal acquisition and conditioning. Electric motors. Design applications in engineering. *Prerequisites:* MATH 20D and MATH 31AH or MATH 18 or MATH 20F, and PHYS 2B.

MAE 87. First-year Student Seminar (1)
The First-year Student Seminar program is designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. First-year student seminars are offered in all campus departments and undergraduate colleges. Topics vary from quarter to quarter. Enrollment is limited to fifteen to twenty students, with preference given to entering first-year students. Prerequisites: none.

MAE 88. Learning Sustainable Well-Being: Compassion for Self and Others, an Engineer's Perspective (1)

This experiential course teaches the art of practicing psychological well-being, based on Eastern and Western approaches (e.g., Mindfulness, Positive Psychology, Cognitive Therapy, Neuroscience, Theatre and Art), from the perspective of an engineer. Each week, there is a short lecture on a given topic, combined with workshop-style exercises. Prerequisites: none.

MAE 91. Introduction to Topics in Mechanical and Aerospace Engineering (4)

An introduction to special topics in mechanical and aerospace engineering. *Prerequisites:* none.

MAE 92A. Design Competition—Design, Build, and Fly Aircraft (1)

(Cross-listed with SE 10A.) Student teams design, build, and fly unmanned aircraft for a national student competition. Students concentrate on vehicle system design including aerodynamics, structures, propulsion, and performance. Teams engineering, fabricate the aircraft, submit a design report, and prep aircraft for competition. *Prerequisites:* consent of instructor.

MAE 93. Design Competition—Design, Build, and Test Race Car (1)

Student teams design, build, and test a formula-style racing car for an international student competition. Students concentrate on vehicle system analysis and design, manufacturability and performance. Teams engineer, fabricate car, submit a design report and prep car for competition. *Prerequisites:* department approval.

MAE 94. Rocketry Competitions—Design and Build Rockets and Space Systems (1)

Student teams design, build, and test different components of rockets and cubesats for national level competitions. Students will be involved in planning, designing, manufacturing, and testing various systems. Team engineers will focus on the feasibility of manufacturing and performance for the targeted competitions. Final design reports will be prepared by the teams. *Prerequisites:* department approval.

MAE 98. Directed Group Study (2)

Directed group study on a topic or in a field not included in the regular departmental curriculum. P/NP grades only. May be taken for credit two times. Credit may not be received for a course numbered 97, 98, or 99 subsequent to receiving credit for a course numbered 197, 198, or 199. *Prerequisites:* department approval.

MAE 99H. Independent Study (1)

Independent study or research under direction of a member of the faculty. *Prerequisites:* student must be of first-year standing and a Regent's Scholar; approved Special Studies form.

Upper Division

MAE 101A. Introductory Fluid Mechanics (4)

Fluid statics; fluid kinematics; integral and differential forms of the conservation laws for mass, momentum, and energy; Bernoulli equation; potential flows; dimensional analysis and similitude. *Prerequisites:* PHYS 2A or 4A and MATH 20D and MATH 20E or MATH 31CH, or consent of instructor. Enrollment restricted to MC 25, MC 27, MC 29, MC 30–34, and MC 35–37 majors only.

MAE 101B. Advanced Fluid Mechanics (4)

Laminar and turbulent flow. Pipe flow including friction factor. Boundary layers, separation, drag, and lift. Compressible flow including shock waves. *Prerequisites:* MAE 101A or CENG 101A, and MAE 11 or MAE 110A or CENG 102, or consent of instructor.

MAE 101C. Heat Transfer (4)

Extension of fluid mechanics in MAE 101A–B to viscous, heat-conducting flows. Application of the energy conservation equation to heat transfer in ducts and external boundary layers. Heat conduction and radiation transfer. Heat transfer coefficients in forced and free convection. Design applications. *Prerequisites:* MAE 101A or CENG 101A, MAE 101B, and MAE 105.

MAE 101D. Intermediate Heat Transfer (4)

Course builds on the MAE fluids sequence, offering more advanced concepts in conduction, convection, radiation, and heat exchanger design. This course covers numerical methods in conduction, boiling, condensation and evaporation analysis, natural and turbulent convection, spectral and directional radiative transfer, heatpipes, thermal design of spacecraft, heat exchanger analysis and design. *Prerequisites:* senior standing and MAE 101C, or consent of instructor.

MAE 104. Aerodynamics (4)

Basic relations describing flow field around wings and bodies at subsonic and supersonic speed. Thin-wing theory. Slender-body theory. Formulation of theories for evaluating forces and moments on airplane geometries. Application

to the design of high-speed aircraft. *Prerequisites:* MAE 101A and 101B, or consent of instructor. Enrollment restricted to MC 25, MC 27, MC 29, MC 30–34, MC 35–37, and SE 27 majors only.

MAE 105. Introduction to Mathematical Physics (4)

Fourier series, Sturm Liouville theory, elementary partial differential equations, integral transforms with applications to problems in vibration, wave motion, and heat conduction. *Prerequisites:* PHYS 2A and B, and MATH 20D or 21D. Enrollment restricted to engineering majors only.

MAE 107. Computational Methods in Engineering (4)

Introduction to scientific computing and algorithms; iterative methods, systems of linear equations with applications; nonlinear algebraic equations; function interpolation and differentiation and optimal procedures; data fitting and least-squares; numerical solution of ordinary differential equations. *Prerequisites:* MAE 8 or 9, and MATH 18 or 20F or 31AH.

MAE 108. Probability and Statistical Methods for Engineering (4)

Probability theory, conditional probability, Bayes theorem, random variables, densities, expected values, characteristic functions, central limit theorem. Engineering reliability, elements of estimation, random sampling, sampling distributions, hypothesis testing, confidence intervals. Curve fitting and data analysis. Students cannot receive credit for MAE 108 and ECE 109, ECON 120A, MATH 180A, MATH 183, MATH 186, or SE 125. *Prerequisites:* MATH 18 or 20F.

MAE 110. Thermodynamic Systems (4)

Thermodynamic analysis of power cycles with application to combustion driven engines: internal combustion, diesel, and gas turbines. Thermodynamics of mixtures and chemical and phase equilibrium. Computational methods for calculating chemical equilibrium. Renumbered from MAE 110B. Students may not receive credit for MAE 110 and MAE 110B. *Prerequisites:* MAE 11 or 110A.

MAE 113. Fundamentals of Propulsion (4)

Compressible flow, thermodynamics, and combustion relevant to aircraft and space vehicle propulsion. Analysis and design of components for gas turbines, including turbines, inlets, combustion chambers and nozzles. Fundamentals of rocket propulsion. *Prerequisites:* MAE 11 or MAE 110A or CENG 102, and MAE 101A or CENG 101A, and MAE 101B or CENG 101C. Enrollment restricted to MC 25, MC 27, MC 29, MC 30–34, and MC 35–37 majors only.

MAE 114. Space Propulsion (4)

This course covers the fundamentals of rocket propulsion and discusses advanced concepts in space propulsion. Topics include liquid and solid propellant rocket engines, electrical rocket propulsion, nuclear propulsion devices, solar-powered vehicles, and current challenges and opportunities in launch vehicle technologies. *Prerequisites:* MAE 113.

MAE 117A. Elementary Plasma Physics (4)

(Cross-listed with Physics 151.) Particle motions, plasmas as fluids, waves, diffusion, equilibrium and stability, nonlinear effects, controlled fusion. Recommended preparation: PHYS 100B–C or ECE 107. *Prerequisites:* MATH 20D or 21D, or consent of instructor.

MAE 118. Introduction to Energy and Environment (4)

Overview of present-day primary energy sources and availability: fossil fuel, renewable, and nuclear; heat engines; energy conservation, transportation, air pollution, and climate change. Students may not receive credit for both MAE 118 and MAE 118A. *Prerequisites:* MAE 101A or CENG 101A, or consent of instructor.

MAE 119. Introduction to Renewable Energy: Solar and Wind (4)

Basic principles of solar radiation—diffuse and direct radiation; elementary solar energy engineering—solar thermal and solar photovoltaic; basic principles of wind dynamics—hydrodynamic laws, wind intermittency, Betz's law; elementary wind energy engineering; solar and wind energy perspectives; operating the California power grid with 33 percent renewable energy sources. Students may not receive credit for both MAE 118B and MAE 119. *Prerequisites:* PHYS 2C or consent of instructor.

MAE 120. Introduction to Nuclear Energy (4)

Overview of basic fission and fusion processes. Elementary fission reactor physics and engineering; environmental and waste disposal issues. Survey of fusion technology issues and perspectives. May not receive credit for both MAE 118C and MAE 120. *Prerequisites:* MAE 101A or CENG 101A, or consent of instructor.

MAE 121. Air Pollution Transport and Dispersion Modeling (4)

Overview of air pollution and wastes and their impact. Characteristics of air pollutants. Air pollution transport. Atmospheric stability. Plume rise and dispersion. Meteorological data. Selecting the appropriate air quality model and case studies. Modeling complex terrain situations. Current air quality modeling issues. Laws and regulations to control air pollution. *Prerequisites:* MAE 122.

MAE 122. Flow and Transport in the Environment (4)

Introduction to the air and aquatic environments. Buoyancy, stratification, and rotation. Earth surface energy balance. Introduction to the atmospheric boundary layer. Advection and diffusion. Turbulent diffusion and dispersion in rivers and in the atmospheric boundary layer. Surface waves and internal gravity waves. *Prerequisites:* MAE 101A or CENG 101A, or consent of instructor.

MAE 123. Introduction to Transport in Porous Media (4)

Introduction to groundwater flow. Pollution transport through the water table. Fundamentals of flow. Single- and multi-phase flow. Darcy law. Well hydraulics. Diffusion and dispersion. Gravity currents and plumes in porous media. Chemistry of fluid-solid interactions. Fundamentals of adsorption and surface reactions. *Prerequisites:* MAE 105, or consent of instructor.

MAE 125. Building Energy Efficiency (4)

Physical building performance including building thermodynamics, daylighting, and solar control. Heat transfer through building envelope, solar geometry, and shading. Heating, ventilation, and air conditioning system design, water heating, microclimates, passive system design, energy efficient design, applicant energy use, cost estimating. Building energy codes and standards. Building design project with whole building energy simulation software. *Prerequisites:* upper-division standing.

MAE 126A. Environmental Engineering Laboratory (4)

Analysis of experiments in Environmental Engineering: Drag in a water tunnel, shading effects on solar photovoltaic, buoyant plume dispersion in a water tank, atmospheric turbulence, and others. Use of sensors and data acquisition. Laboratory report writing; error analysis; engineering ethics. *Prerequisites:* MAE 101A or CENG 101A; MAE 170.

MAE 126B. Environmental Engineering Design (4)

Fundamental principles of environmental design. Building a working prototype or computer model for an environmental engineering application. Work in teams to propose and design experiments and components, obtain data, complete engineering analysis, and write a report. Engineering ethics and professionalism. *Prerequisites:* MAE 126A.

MAE 130. Advanced Vibrations (4)

Harmonically excited vibrations. Vibration of multiple degree-of-freedom systems. Observations, including beat frequencies, static and dynamic coupling, traveling, and standing wave phenomena. Vibration of continuous systems. Hamilton's equations. Distributed and point forces and moments in continuous systems and the generalized Dirac

distribution. Response to impact and impulse excitation. Modeling continuous systems with approximate discrete models. Restricted to engineering majors only MC 25, MC 27, MC 29, MC 30–34, MC 35–37, MO 21, SE 27. *Prerequisites:* MATH 18 or MATH 31AH and MAE 30B.

MAE 131A. Solid Mechanics I (4)

Concepts of stress and strain. Hooke's Law. Axial loading of bars. Torsion of circular shafts. Shearing and normal stresses in beam bending. Deflections in beams. Statically determinate and indeterminate problems. Combined loading. Principal stresses and design criteria. Buckling of columns. *Prerequisites:* MATH 20D and MAE 30A or MAE 130A or SE 101A.

MAE 131B. Fundamentals of Solid Mechanics II (4)

Analysis of 3-D states of stress and strain. Governing equations of linear elasticity. Solution of elasticity problems in rectangular and polar coordinates. Stress concentration. Failure criteria. Torsion of noncircular and thin walled members. Energy methods. Plastic collapse and limit analysis. *Prerequisites:* MAE 131A or SE 110A and MAE 105. Enrollment restricted to engineering majors only.

MAE 133. Finite Element Methods in Mechanical and Aerospace Engineering (4)

Development of stiffness and mass matrices based upon variational principles and application to static, dynamic, and design problems in structural and solid mechanics. Architecture of computer codes for linear and nonlinear finite element analysis. The use of general-purpose finite element codes. *Prerequisites:* MAE 131A or SE 110A.

MAE 142. Dynamics and Control of Aerospace Vehicles (4)

The dynamics of vehicles in space or air are derived for analysis of the stability properties of spacecraft and aircraft. The theory of flight, lift, drag, Dutch roll and phugoid modes of aircraft are discussed. Optimal state space control theory for the design of analog and digital controllers (autopilots). *Prerequisites:* MAE 104 and MAE 143B or ECE 171A, or consent of instructor. Enrollment restricted to engineering majors only.

MAE 143A. Signals and Systems (4)

Dynamic modeling and vector differential equations. Concepts of state, input, output. Linearization around equilibria. Laplace transform, solutions to ODEs. Transfer functions and convolution representation of dynamic systems. Discrete signals, difference equations, z-transform. Continuous and discrete Fourier transform. *Prerequisites:* MATH 20D or 21D, MATH 20E, MATH 18 or 20F or 31AH, or consent of instructor.

MAE 143B. Linear Control (4)

Analysis and design of feedback systems in the frequency domain. Transfer functions. Time response specifications. PID controllers and Ziegler-Nichols tuning. Stability via Routh-Hurwitz test. Root locus method. Frequence response: Bode and Nyquist diagrams. Dynamic compensators, phase-lead and phase-lag. Actuator saturation and integrator wind-up. *Prerequisites:* MAE 143A or consent of instructor.

MAE 144. Embedded Control and Robotics (4)

Each student builds, models, programs, and controls an unstable robotic system built around a small Linux computer. Review/synthesis of: A) modern physical and electrical CAD. B) dynamics, signals and systems, linear circuits; PWMs, H-bridges, quadrature encoders. C) embedded Linux, C, graphical programming; multithreaded applications; bus communication to supporting ICs. D) classical control theory in both continuous-time (CT) and discrete-time (DT); interconnection of CT and DT elements. Program or materials fees may apply. *Prerequisites:* upper-division standing or graduate student, and MAE 143B or BENG 122A or ECE 171A, or consent of instructor.

MAE 145. Introduction to Robotic Planning and Estimation (4)

This course is an introduction to robotic planning algorithms and programming. Topics include sensor-based planning (bug algorithms), motion planning via decomposition and search (basic search algorithms on graphs, A*), the configuration-space concept, free configuration spaces via sampling, collision detection algorithms, (optimal)

planning via sampling (probabilistic trees), environment roadmaps, and filtering for robot localization and environment mapping (SLAM). *Prerequisites:* MAE 8, MAE 108, and senior standing or consent of instructor.

MAE 146. Introduction to Machine Learning Algorithms (4)

An introduction to the principles used to design and implement machine learning algorithms, as well as an understanding of their advantages and limitations. The topics covered are python review, supervised learning (linear, logistic/sigmoid regression, generalized linear models, nonlinear regression via Kernels), neural network types (convolutional, recurrent, deep NN), unsupervised learning (k-means clustering). Application of ML in different examples. Recommended preparation: ECE 143 and/or python programming knowledge. *Prerequisites:* (MATH 31AH or MATH 18) and (MATH 20C or MATH 31BH) and MAE 8 and (MAE 108 or ECE 109 or SE 125 or MATH 186 or MATH 183 or MATH 180A or ECON 120A).

MAE 148. Introduction to Autonomous Vehicles (4)

(Cross-listed with ECE 148.) Fundamentals of autonomous vehicles. Working in small teams, students will develop 1/8-scale autonomous cars that must perform on a simulated city track. Topics include robotics system integration, computer vision, algorithms for navigation, on-vehicle vs. off-vehicle computation, computer learning systems such as neural networks, locomotion systems, vehicle steering, dead reckoning, odometry, sensor fusion, GPS autopilot limitations, wiring, and power distribution and management. *Prerequisites:* ECE 15 or ECE 35 or MAE 2 or MAE 3 and department approval.

MAE 149. Sensor Networks (4)

(Cross-listed with ECE 156.) Characteristics of chemical, biological, seismic, and other physical sensors; signal processing techniques supporting distributed detection of salient events; wireless communication and networking protocols supporting formation of robust censor fabrics; current experience with low power, low-cost sensor deployments. Students may not receive credit for both MAE 149 and ECE 156. May be coscheduled with SIOC 238. *Prerequisites:* upper-division standing.

MAE 150. Computational Methods for Design (4)

Computer-aided analysis and design. Design methodology, tolerance analysis, Monte Carlo analysis, kinematics and computer-aided design of linkages, design of cams and cam dynamics, design optimization, finite element analysis fundamentals, design using commercially available CAD and analysis software. *Prerequisites:* MAE 30A or MAE 130A or SE 101A or BENG 110, MAE 107 or SE 121, MAE 3 or MAE 2, and senior standing in engineering major, or consent of instructor.

MAE 152. Introductions to Manual and CNC Machining (1)

In this class, students are introduced to precision machining. Students will learn the proper safe operating procedures of a manual mill and lathe, band saws, and hand tools. Other topics include the basics of tolerancing, design (Fusion 360), and operation of CNC milling and turning. Program or materials fees may apply. Recommended preparation: It is recommended that students take introduction to design process through a hands-on design project course or some other introduction to shop course. *Prerequisites:* MAE 3 or MAE 2 and consent of instructor.

MAE 153. Design of Machine Components (4)

An introduction to the fundamentals of machine design in mechanical and aerospace engineering. The course covers the principles of failure theories, design methodologies, and their application in essential machine elements and structures. Topics include analyzing components by applying the theories from statics, dynamics, and mechanics of materials; static and fatigue failure theories; and designing machine components, including shafts, gears, bearings, fasteners, and geometric dimensioning and tolerancing. *Prerequisites:* MAE 131A.

MAE 154. Product Design and Entrepreneurship (4)

This course will teach teams of students how to develop concepts and business plans in the design of new and innovative products. Emphasis will be placed on identifying user needs, concept generation, and prototype fabrication. *Prerequisites:* upper-division standing and consent of instructor.

MAE 155A. Aerospace Engineering Design I (4)

Fundamental principles of aerospace vehicle design including the conceptual, preliminary, and detailed design phases. Aeronautical or astronautical design project that integrates all appropriate engineering disciplines as well as issues associated with optimization, teamwork, manufacturability, reporting, and professionalism. *Prerequisites:* MAE 2, MAE 21, or SE 2 or SE 104, MAE 104, MAE 30B or MAE 130C, and SE 160A, or consent of instructor.

MAE 155B. Aerospace Engineering Design II (4)

The principles of aerospace vehicle design including the conceptual, preliminary, and detailed design phases. Aeronautical or astronautical design project that integrates all appropriate engineering disciplines as well as issues associated with optimization, teamwork, manufacturability, reporting, and professionalism. Program or materials fees may apply. *Prerequisites:* MAE 113, MAE 142, MAE 155A, and MAE 170, or consent of instructor.

MAE 156A. Fundamental Principles of Mechanical Design I (4)

Fundamental principles of mechanical design and the design process. Application of engineering science to the design and analysis of mechanical components. Initiation of team design projects that culminate in MAE 156B with a working prototype designed for a real engineering application. Professional ethics discussed. Program or materials fees may apply. *Prerequisites:* MAE 3, MAE 30B, MAE 131A, MAE 150, and MAE 170, or consent of instructor. Open to major codes MC 27 and MC 30–34 only.

MAE 156B. Fundamental Principles of Mechanical Design II (4)

Fundamental principles of mechanical design and the design process. Culmination of a team design project initiated in MAE 156A which results in a working prototype designed for a real engineering application. *Prerequisites:* MAE 156A in the immediately preceding quarter, MAE 101C, MAE 143B, and MAE 160 or MAE 131B. Open to major codes MC 27 and MC 30–34 only.

MAE 160. Mechanical Behavior of Materials (4)

Elasticity and inelasticity, dislocations and plasticity of crystals, creep, and strengthening mechanisms. Mechanical behavior of ceramics, composites, and polymers. Fracture: mechanical and microstructural. Fatigue. Laboratory demonstrations of selected topics. *Prerequisites:* MAE 20, MAE 30A or MAE 130A or SE 101A, and MAE 131A, or consent of instructor.

MAE 165. Fatigue and Failure Analysis of Engineering Components (4)

The engineering and scientific aspects of crack nucleation, slow crack growth, and unstable fracture in crystalline and amorphous solids. Microstructural effects on crack initiation, fatigue crack growth and fracture toughness. Methods of fatigue testing and fracture toughness testing. Fractography and microfractography. Design safe methodologies and failure prevention. Failure analysis of real engineering structures. *Prerequisites:* consent of instructor.

MAE 166. Modern Concepts in Nanotechnology (4)

(Cross-listed with NANO 156.) This course offers a worm's eye perspective on recent developments on nanomaterials through case studies building on basic principles of synthesis techniques, processing, microstructural control, and unique physical properties of materials in nanoscale dimensions. Particular focus will be given to physical properties and technological applications of nanowires, quantum dots, and thin films. Students may not receive credit for both NANO 156 and MAE 166. *Prerequisites:* upper-division standing.

MAE 167. Wave Dynamics in Materials (4)

Pressure and shear waves in infinite solids. Reflection and diffraction. Rayleigh and Love waves in semi-infinite space. Impulse load on a half space. Waveguides and group velocity. *Prerequisites:* consent of instructor.

MAE 170. Experimental Techniques (4)

Principles and practice of measurement and control and the design and conduct of experiments. Technical report writing. Lectures relate to dimensional analysis, error analysis, signal-to-noise problems, filtering, data acquisition and data reduction, as well as background of experiments and statistical analysis. Experiments relate to the use of electronic devices and sensors. *Prerequisites:* PHYS 2C or PHYS 4B and PHYS 2CL or MAE 140 or MAE 40. Enrollment restricted to MC 25, MC 27, MC 29, MC 30–34, MC 35–37, BE 25, BE 27.

MAE 171A. Mechanical Engineering Laboratory I (4)

Design and analysis of experiments in fluid mechanics, solid mechanics, and control engineering. Experiments in wind tunnel, water tunnel, vibration table and material testing machines, and refined electromechanical systems. Laboratory report writing; error analysis; engineering ethics. *Prerequisites:* MAE 101A, MAE 143B, and MAE 170. Enrollment restricted to MC 27 and MC 30–34 majors only.

MAE 171B. Mechanical Engineering Laboratory II (4)

Design and analysis of original experiments in mechanical engineering. Students research projects using experimental facilities in undergraduate laboratories: wind tunnel, water channel, vibration table, and testing machine and control systems. Students propose and design experiments, obtain data, complete engineering analysis and write a major report. *Prerequisites:* MAE 171A.

MAE 175A. Aerospace Engineering Laboratory I (4)

Analysis of aerospace engineering systems using experimental facilities in undergraduate laboratories: wind tunnel, water channel, vibration table, and testing machine. Students operate facilities, obtain data, complete engineering analysis and write major reports. *Prerequisites:* senior standing; MAE 143B or CENG 120; and MAE 170, or consent of instructor.

MAE 180. Orbital Mechanics (4)

Students perform analyses based on mission requirements. Selected topics include astrodynamics, orbital motion, perturbations, coordinate systems and frames of reference, ground tracks and classification of common orbits, orbit determination, orbital maneuvers, station keeping, orbit injection and launch geometry, and interplanetary and lunar trajectories.

MAE 181. Space Mission Analysis and Design (4)

Space mission concepts, architectures, and analysis. Mission geometry. Astrodynamics. Orbit and constellation design. Space environment. Payload and spacecraft design and sizing. Power sources and distribution. Thermal management. Structural design. Guidance and navigation. Space propulsion. Orbital debris and survivability. Cost modeling and risk analysis. *Prerequisites:* upper-division standing or consent of instructor.

MAE 182. Spacecraft Guidance and Navigation (4)

Navigational and guidance requirements for orbital, planetary, and atmospheric entry missions. Guidance systems. Observation instrument point, tracking, control. Celestial, radio, and inertial navigation schemes. Link budgets, antennas, and telemetry systems. *Prerequisites:* MAE 108 and MAE 180. Recommended enrollment in MAE 143B before or concurrently.

MAE 184. Flight Simulation Techniques (4)

Students will develop software and methods to simulate the motion characteristics of flight vehicles. Six degree-of-freedom equations of motion will be reviewed with emphasis on computer implementation. Algorithms for data modeling, numerical integration, equilibrium, and linearization will be introduced. Three-dimensional visualization techniques will be explored for representing operator and observer viewpoints. Applications include aircraft, launch vehicles, automobiles, and marine vessels. *Prerequisites:* upper-division standing or consent of instructor.

MAE 185. Computational Fluid Mechanics (4)

This course will cover numerical solutions of the compressible and incompressible Navier-Stokes equations using finite difference and finite volume discretization with a primary emphasis on programming and a secondary emphasis on application of commercial tools. Introduction to flow visualization will also be covered. *Prerequisites:* MAE 101B and MAE 107.

MAE 190. Topics in Mechanical and Aerospace Engineering (4)

Topics of special interest in mechanical and aerospace engineering. May be repeated for credit as topics vary. *Prerequisites:* upper-division standing.

MAE 191. Topics in Mechanical and Aerospace Engineering with Laboratory (4)

Topics of special interest in mechanical and aerospace engineering with laboratory. May be repeated for credit as topics vary. *Prerequisites:* upper-division standing.

MAE 197. Engineering Internship (1–12)

Students work in local industry or hospitals under faculty supervision. Units may not be applied toward graduation requirements. Salaried or unsalaried. Number of units determined by enrollment frequency. First quarter up to four units. Subsequent quarters cannot exceed one unit. *Prerequisites:* consent of instructor and department stamp, 2.50 overall GPA minimum, at least ninety units.

MAE 198. Directed Group Study (1–4)

Directed group study on a topic or in a field not included in the regular department curriculum, by special arrangement with a faculty member. May be taken P/NP only. *Prerequisites:* consent of instructor.

MAE 199. Independent Study for Undergraduates (1–4)

Independent reading or research on a problem by special arrangement with a faculty member. P/NP grades only. *Prerequisites:* consent of instructor.

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